Hydrolysis of Carbonyl Sulfide: Equilibrium and Kinetic Studies on a Major Downstream Sour-Gas Source

P.D.N. Svoronos
Department of Chemistry
City University of New York
Bayside, NY 11354 U.S.A.

T.J. Bruno
Physical and Chemical Properties Division
National Institute of Standards and Technology
325 Broadway
Boulder, CO 80303 U.S.A.

Carbonyl sulfide (COS) is a naturally occurring component of natural gas and liquefied petroleum gas (LPG). It is an odoriferous fluid that was at one time used as an odorizing compound for both natural gas and LPG. In recent years, it has become a recognized source of downstream sour-gas (that is, a source of acid components that develop in gas after treatment). While not itself corrosive, COS will hydrolyze (react with water) to form carbon dioxide and hydrogen sulfide. The reaction is base-catalyzed and is also autocatalytic. In this presentation, we will review some of the basic chemistry that affects the hydrolysis of COS. The recent literature on COS hydrolysis will also be summarized briefly. We will then describe a new reaction/equilibrium apparatus that has been designed and constructed to study the reaction. This apparatus utilizes a fused silica lined pressure vessel to contain the reaction mixture. The reaction is then followed on-line by gas chromatography, using simultaneous flame ionization and sulfur chemiluminescence detection. We will then discuss the kinetic and equilibrium results that have been obtained for this reaction using this apparatus. The potential catalytic activity of wetted surfaces will also be discussed. The measurement of this activity is done by reaction chromatography and by autoclave tests. Preliminary kinetic data on catalytic activity will be discussed. Finally, we will discuss plans for a predictive tool that will be developed from the measurement work.